A REPORT ON
TIMBER CONDITIONS
IN THE
DUTCH CREEK AREA

PROVINCE OF ALBERTA
DEPARTMENT OF LANDS & FORESTS

COMPILED BY THE
FORESTS DIVISION

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF LANDS AND FORESTS

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INDEX

AREA:

The Dutch Creek Timber, so-called because the heaviest portion of it lies around the upper waters of this creek, comprises approximately 1/4 of the area and 1/3 of the volume of mature timber in the Crowsnest Forest Reserve. Its original area more than halved by fire, it still represents one of the largest blocks of timber in southwestern Alberta.

Inaccessibility of the area and its apparent freedom from incidental fire hazard seem to have been the main reasons for its preservation as a block. A small cutting in the extreme southeasterly tip of the area is the only recorded operation.

The area was cruised by the Dominion Forest Service during 1921-22 and their estimate on 7/8 of the area was approximately 800 million board feet.

The same area was re-cruised this summer by a Provincial team consisting of Messrs. Hughes, Bradwell, Walton, Plante, Cawley and Bloomberg, the latter being in charge of the party. A detailed check was made, greatly assisted by aerial photographic coverage.

For convenience the area was divided into five blocks, corresponding to the minor watersheds of the area. Their respective areas are given below (See Map)

Vicary Block	4,633	acres
South Racehorse Block	14,084	"
North Racehorse "	9,519	"
East Dutch "	14,205	"
West Dutch "	11,745	"
Total Area	54,186	" or 84.7 sq. miles

Approximately 49,000 acres or 93% of this is timbered the balance consisting of burn, barren areas etc. (See Appendix 1.)

The long axis of the area runs north to south and it is approximately 14 miles long and at its widest point 12 miles wide, although the average width of the area is about 6 miles. The area lies in Townships 10 and 11 in Range five and the north half of Township 9 in the same range. The easterly margins of the area extend into the west half of Range 4. The full legal description of the area is given in Appendix 2.

GEOGRAPHICAL LOCATION: (See Map)

The Dutch Creek area lies in the west half of a rectangle formed by Hidden creek, the Oldman River, the Crowsnest River and the Rocky Mountains divide on the north, east, south and west boundaries respectively, although it lies some ten miles north of the Crowsnest River. Major communication routes exist to the south and east of the area. The southern limit lies 13 miles north of No. 3 Highway and is connected thereto by the Allison Creek Road at a point 4 miles west of Coleman. Shipping points

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are at Coleman and Blairmore on the C.P.R. transcontinental line.

The present construction of the Forestry Trunk Road north from Coleman facilitates access to the east limit of the area. Feeder roads built west would open up a large area. The nearest shipping point southeast of the area is at Lundbreck, also on the No. 3 Highway and some 40 miles southeast. A second class road from this point to the Gap Ranger Station is in existence but with the early completion of the Trunk Road, use of the former would not be heavy.

There are no driveable streams in the area and driving the Oldman River to Lethbridge would be a doubtful proposition on account of numerous shallows and gravel bars. Logical markets and distribution points for the products exist at Coleman, Blairmore, Calgary, Lethbridge and Macleod.

It is clear that the larger part of the area is not at present accessible by road and that the construction of a considerable mileage of haul road is inevitable. This is discussed under the heading of "Exploitation Facilities".

A table showing distances to the principal towns and cities in the area is shown below:

Coleman	60	miles	via Lundbreck
Coleman	14	"	" Trunk Road
Pincher Creek	54	miles	
Macleod	80	"	
Lethbridge	110	"	
Calgary	184	"	

TOPOGRAPHY:

Five minor watersheds are represented in the Dutch Creek Area, those of East and West Dutch Creek, North and South Racehorse Creeks and Vicary Creek. A very small portion of Hidden Creek is included on the north boundary. These in turn are subsidiary to the major watershed of the Oldman River which stretches westerly to the Divide. Subject to the major accidence sloping easterly from the Divide this formation determines the main topographical lines of the area. Major creeks flow easterly with a few notable exceptions. Thus the Upper reaches of Dutch Creek flow almost due south and Upper Racehorse flows in a north-easterly direction. Between these creeks the heights of land which define the minor watersheds are fairly sharp and with the exception of the Upper Dutch Creek Basin rise to 6,000' in elevation.

Upper Dutch Creek Basin showing Mount Erris in background.

Rock Slide in North Fork Pass.

In the latter case the steep slopes of the West Dutch and North Racehorse watersheds flatten out to form a shallow divide. This gently sloping land results from glaciation and supports the heaviest stands of timber.

Creek valleys are generally narrow, not exceeding 50 yards in many places, and the slopes rise steeply to the heights of land, attaining 7,500' between Vicary and Racehorse Creeks. Toward the confluence of north and south Racehorse Creeks, the terrain levels off into a wide valley.

All creeks in the area are swift-flowing and clear. The fall is rapid and winding courses accompanied by scour and bankslide are characteristic. Marked canyon formation has taken place in the sandstone formation of a tributary to South Racehorse and waterfalls with a drop of 15' are present.

The highest peaks occur in and close to the Divide, e.g. Gould Dome 9490'; Mt. Erris 9290'. Mountain blocks in the area itself do not exceed 7500' e.g. Fly Hill and Racehorse Overlook. Rock outcrops are plentiful on higher slopes and there are many indications of snow and rock slides. Large slides are in evidence close to the divide where in some cases several acres of forest have been swept away or covered.

The terrain then is rugged and highly erodible, there are few level areas other than narrow creek bottoms, and ridges rather than plateaux mark heights of land. This no doubt adds to the scenic quality of the area but it also marks it as a danger point for widespread erosion and any logging plan will be controlled to a large extent by this factor.

SOIL CONDITION:

Most of the underlying geological formation is lower cretaceous with palaeozoic intrusions in the south. That is, the formation is geologically mature. Subsequent overlying formations such as the coal-bearing Blairmore which predominates in the area are typified by coal outcrops, sandstone shales (noticeable along river banks) and large conglomerate boulders which have severed from the main mass and rolled down into stream beds. Minerals, including coal, some galena and felspar are probably abundant.

A large part of the area shows evidence of glaciation which was observed up to 7000'.

The soil formation throughout the area, is relatively immature. Horizontal development is primitive, rudimentary stages being found only in grassy meadows. Here soil pits showed a 2" horizon of well-decomposed humus above a 5" layer of fine clay loam. The underlying soil consisted of a grey clay showing incipient pan formation at 5". Stream bed boulders were found in the clay. This formation containing fine silt particles is alluvial in origin.

A pit dug beneath a pine stand with an incoming spruce understory showed 2" of well decomposed humus followed by 1" of friable loam and a well-packed sandy loam subsoil. Contrasting with this was the soil formation found under a dense mature spruce stand. Here a thick carpet of polytridrium moss covered a 3½-4" layer of matted undecomposed humus. Below this a clay loam showed no horizontal development. This humus layer was rich in fungal strands and a rough analysis in a pail of water showed the following content:

Moss	50%
Rotted wood, leaf litter, twigs, etc.	38%
Cone scales, seeds etc.	15%
Sandy particles	5%

The development of upper slope soils was primitive. Shallow lithosols consisting only of a grey clay interspersed with rock fragments were covered by 4" of raw humus.

Overall the humus layer in most sites supporting pure spruce showed insufficient decomposition attributable to a lack of heat and light. The deterrent effect on the successful germination of spruce seedlings was very great and it will be necessary to hasten decomposition by sylvicultural measures.

USES:

There is no alienation of area in respect of surface rights in the Dutch Creek Area apart from a small portion of Section 3, Township 11, Range 4. There are coal leases in the names of the MacGillvray Creek Coal Company and H. J. and H. A. Howard. These are mostly in the Vicary and South Racehorse area. A list of lessees and legal descriptions is given in Appendix III.

There are two traplines on Dutch and South Racehorse Creeks belonging to Messrs. Miller and Caesar respectively.

There are no records of other uses or claims although there are evidences of former surveys in the nature of blazed and cut lines throughout the bush. There is no evidence on record of logging in the Dutch Creek Area save in Section 20, Township 9, Range 4, where a small area has been cut.

Apart from possible development of coal claims during the Sale period there can be no confliction of private interests.

SYLVICULTURAL CONDITIONS:

Recognition of many stand types in the area necessitated a fairly complex classification system based on composition, average height and average diameter. Examination of individual stands was made with reference to this classification, a description of which properly belongs under the heading of "Estimate" but which it will be necessary to explain before a complete description of sylvicultural conditions can be made.

COMPOSITION:

The first criterion in stand classification was the composition of cover type. Four classes were distinguished:

S – 76 – 100% Spruce-fir by volume, balance pine
R – 51 – 75% " " " " " "
Q – 26 – 50% " " " " " "
P – 1 – 25% " " " " " "

The allocation of a type to its composition class was made by comparing volume percentage of each species present in the type.

P- and S- types may be said to be "temporarily stable" as each occurs at opposite extremes of the natural succession cycle. An area burned over will almost certainly produce a solid stand of young pine (P-type) as its first tree crop if and when such a crop appears. This pioneer type gradually prepares soil and environmental conditions suitable for the emergence of spruce which is seeded to the area by trees in stands left intact. The successful establishment of a spruce understory gradually gaining dominance will in turn produce Q- and R- types which are mixture types and relatively unstable since the shorter life of the residual pine will eventually evolve to the climatic type - pure spruce with fir admixture or the S- type. Exceptions to this sequence were rare in the Dutch Creek Area, a few mature pine stands (P-IV) types being found in the South Racehorse Block where some agency had precluded successful seeding of spruce.

A table showing the average composition of Cover types for all height and density classes is shown below:

Type	Percent Composition		
	SW	Pl	Fb
S	88	9	3
R	57	36	7
Q	28	67	5
P	8	6	86

HEIGHT:

Average dominant height was determined in each stand and used as the second variable in differentiating types. The total volume of S.-types as related to height class is shown below:

S-III	S-IV	S-V
8075 FBM per ac.	13630 FBM. per ac.	15160 FBM per ac.

The types are of the same density class for fair comparison.

Five height classes were distinguished but only the last three were found in the Dutch Creek Area.

I	1' - 20'
II	21' - 40'
III	41' - 60'
IV	61' - 80'
V	81' - and up

The fifth height class typifies a better-than-average site and is generally found where the spruce content of the stand is significant as in S- and R- types. Height was contingent on elevation overall though steep slopes did not prevent good height growth. Height class four was considered average for lower and good for upper slopes. Most classifications fell in this group and nearly all mixture types. In the latter case pine seldom exceeded 70' and exercised a constraint. The third height class was found to be a less mature condition of four, the younger stems not exceeding an average height of 60'.

Average heights for each cover type are given below:

Cover Type	Height Class		
	V	IV	III
S	86'	71'	58'
R	88'	72'	48'
Q	-	66'	48'
P	-	63'	51'

It was found that height grown was proportional to the spruce composition of the stand. Thus S - V types contained 95% spruce by volume and 5% of other species. S - IV types contained 85% and 15% respectively while S - III contained 80% and 20% respectively.

DENSITY:

Density was also recognized as a volume producing factor its effect is apparent from the following figures:

type	S - V - D	S - V - C	S - V - B
FBM per ac.	35410	26845	15160

Four density classes were distinguished;

A	1% - 25%	stocked
B	26% - 50%	"
C	51% - 75%	"
D	76% - 100%	"

The spacing figure, or relation of average diameter to average distance between trees, expressed as $\frac{D}{d}$ was the basis for calculating Density. The average spacing figure for forest-grown spruce has been found to centre around 14 (Matthews - Management of American Forests). This figure was accepted as a standard and four 25% classes were derived from it. Calculation of density was made in individual stands from average diameter and number of stems per acre over 10" D.B.H. This may really be expressed as "merchantable density" since it is necessary to segregate size classes when using this method, which is also the basis of the Stand Density Index. (See Appendix VIII).

As mentioned above all density classes were not found in each cover - height class. Thus no A - density was found in any but young pine stands nor were D - classes found in other than S - V types. The effect of site on density is evident.

Composition of the whole area by major type classes is given below:

Type	Area	Percentage	Remarks
S - IV	17570 acres	36	Average spruce Stands
R - IV	7987 "	16	Mixture Stands
S - V	7893 "	16	Good site spruce
Q - IV	3757 "	8	Mature pine with spruce admixture.
P - III	3846 "	8	Immature pine
Others	7821 "	16	5 other types averaging 3%

North Fork Pass.

Typical S - V type. Note heavy snowberry growth.

AGE AND INCREMENT:

Apart from the ability of better sites to produce larger diameters in a shorter period, age bore no direct relationship to diameter growth in the mature spruce stand. Thus such diversified figures are found in the same site and location.

DBH	Age
11.5	162 years
6.3	160 "
8.7	149 "
9.5	255 "

All measurements are on Spruce.

In actual fact the relationship is reduced to the ability of a site to produce a certain number of the same diameters in a given period. Only a limited number of the largest diameters will be produced, the remainder consisting of smaller trees of the same age which will require a further growing period to achieve the larger diameters. Some of these will not increase appreciably before they die.

If the genesis of all the spruce stands in the Dutch Creek Area was attributable to events described in the foregoing section, a completely even-aged condition might be expected within individual stands.

Not only is this broadly true, but a similar age condition was found over the whole area. Measurements over the whole area indicated the following distribution:

Age Class	Percentage of trees measured
0 - 50 years	Nil
50 - 100 years	Nil
100 - 150 "	1%
150 - 200 "	12%
200 - 250 "	57%
250 - 300 "	25%
300 - 350 "	Nil
350 years plus 500	5%

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[illegible]

[illegible]

Since 60% of the trees lie in the 200 - 250 year age class it can be argued that not only were individual stands regenerated by fire, but that the whole area was subjected to fire during that 50 year period. Subsequent seedings by the established stand will account for the 13% of the trees from 100 - 150 years old and it is reasonable to assume that 5% of the trees whose ages range from 350 - 500 years managed to escape the fire. Thus an age range of 100 - 250 years is found in one stand with 60% of the trees 200 - 250 years old. The significant point is that there are hardly any trees in S - types below 100 years old. The smaller stems which might be expected to form this class are all totally suppressed mature individuals whose yearly increment is negligible. Periodic diameter increment for these trees is given below:

DBH	Age	Periodic Diameter Increment (in inches)					
		0-20 yrs.	20-40 yrs.	40-60	60-80	80-100	100-120
3.1	100	1.0	.5	.5	.6	.6	-
4.6	105	1.4	.8	.6	.4	.8	-
5.8	120	1.0	1.2	.7	.6	.8	.4
6.3	150	1.1	1.0	.7	.6	.8	.4

This then is a condition falling partway between an even-aged and an irregular forest. It is even-aged to the extent that more than half the forest was regenerated in a definite period and irregular in that the balance was supplied by reseeding within the established stand until some agency precluded regeneration. Assessing it as both a normal even-aged and all aged forest gives the following mean annual Increments:

Type	Volume per Acre	Age	Average	M A 1
			As an even-aged forest	As an all-aged forest x
S - V - D	35410 FBM	260	136 FBM	272 FBM
S - IV - C	22035 "	200	110 "	220 "
S - IV - B	13630 "	240	57 "	114 "

x Using Von Mantel's formula.

Assuming a mean figure to be correct the average annual increment for each type would be:

S - V - D	204	FBM per acre
S - IV - C	165	FBM per acre
S - IV - B	85	FBM per acre

Again assuming that S - III - B type to be an immature condition of the S - IV - B, the difference of their volumes divided by the difference of their ages will theoretically give the increment during that period.

Type	Volume	Age
S - IV - B	13630	240
S - III - B	8075	180
Difference	5555	60
Annual increment equals		92 FBM per acre

This is fairly close to the figure obtained by formula and it may be reasonably assumed that increments for the remaining types are equally correct. These represent 0.5%; 0.8%; 1.0% approximately. In round figures the volume of the whole area would increase four million board feet a year. Owing to the irregular condition caused by extreme suppression in the spruce stands, Stand Increment was difficult to assess in the absence of previous records on Yield Tables. It became clear however, that low increment did not necessarily mean over-maturity, but rather it showed a condition in the stand which could be alleviated by correct sylvicultural treatment sufficient to justify the continued life of the stand.

Further increment investigation was made in the stem analysis of a spruce tree 15.7" DBH and 240 years old.

Increment is tabulated below:

Age	Periodic Annual Increment	%	Mean Annual Increment
120-150	0.5 FBM	0.3	0.025 FBM
150-180	1.2	2.2	0.11
180-210	2.0	1.8	0.30
210-240	2.5	1.3	0.8

This tree did not contain any merchantable timber until it was 120 years old, the DBH and height at that age being 8.1" and 52' respectively. The increasing increment after that age illustrates the extraordinary capacity of spruce to recover after a long period of suppression. Actually the increment is still rising and will probably continue to do so since the M.A.1 has not yet exceeded the P.A.1.

The peculiar dormancy of spruce under suppression is responsible for an apparent overmature appearance in mature stands and many symptoms associated with it. Once released however, the tenacity with which the trees hold on to life seems to be converted into growth vigor and hence it is possible for a tree to double its growth in a third of a period.

The significance of this is discussed under "Conclusions".

DIAMETER GROWTH:

No diameter tallied in any type exceeded 31" DBH and this latter figure was exceptional. Generally the upper limit was 24" DBH. The average diameters of most mature types lay between 12-15" DBH. Pine seldom exceeded 18" DBH. Fir in rare cases goes to 19" DBH where the trees were growing in association with large spruce stems.

The distribution by diameter classes in all types showed a fairly consistent frequency. Volume per acre rose in proportion to diameter, reaching a peak which varied with the Composition Class.

The table below gives the culmination of each curve opposed to its respective diameter class:

Type	DBH Class at Culmination
S - V	16" - 18" DBH
S - IV	13 - 15
S - III	7 - 9
R - IV	10 - 12
R - III	7 - 9
Q - IV	7 - 9
Q - III	7 - 9
P - III	7 - 9

The trend of these curves therefore indicates that the volume-producing diameters of each type increase in size in proportion to:

(1) The Spruce content of the stand.
(2) The average height of the stand.

This is in accordance with both the longer life of spruce and the ability of the latter stands to support a greater number of larger stems to the acre than is possible in stands with significant pine content.

These comparisons are relative and are independent of the actual volume produced by each diameter class which of course is proportional to all three volume-producing factors i.e. Cover type, height and density class. This is made clear from the following figures taken from the S - and R. - types:

Type	Culminating Diameter	Volume
S-V-D	16" - 18"	9.0 M FBM per acre
S-V-C	16 - 18	7.2 " " "
S-V-B	16 - 18	5.6 " " "
R-IV-C	10" - 12"	6.8 " " "
R-IV-B	10 - 12	4.4 " " "

Distribution by number of stems indicated a large number of smaller stems in the 7 - 9 inch diameter class and a rapid fall with diameter increases.

The shape of each Diameter-volume curve showing greatest volume in the culminating class again illustrates the capacity of a site to produce a certain diameter within a given period. The incidence of many 13" stems in the 200-250 age-class indicates that this may be standard for the Dutch Creek Area as a whole.

DISEASE AND INSECTS:

The insect population was low to normal over most of the Dutch Creek Area. This is attributable in part to the lack of susceptible young stands and in part to natural tree vigor. Assessment was based on observation only, it being understood that a Dominion representative was to make a comprehensive survey of the area. The most prevalent insect was spruce bud aphis which was prevalent on spruce regeneration wherever it occurred. This pest also infested fir to a lesser extent and would become a menace in the event of larger areas of regeneration being established.

Fungal attack on mature spruce was very limited, none of the test trees bored showing signs of butt-rot. Red rot was very pronounced in stagnated pine stands, in some cases only an outer shell of wood being found on boring. Since the rapid decay of this species does not interfere with the sylvicultural plan no measures are recommended.

CULL:

The Cull Factor was based both on form and rot. As might be expected it varies in proportion to the vigor of the stand. S-V types seldom showed a cull factor greater than 5% and this was largely due to poor form. Average S-IV type cull factors range from 5-20% although 9% was the upper limit in most cases. If an overall figure for cull were to be estimated, 10% would be an all-inclusive figure. Cull factor is not taken into account in the estimate since it is preferable to state these separately than to guarantee a certain quantity of cull-free timber.

WINDFALL:

Windfall also showed relationship with the vigor of the stand but was dependent on density as well as height growth, V-D height-density classes contained the lightest windfall IV-B often the heaviest. Stands containing over 50% pine were very clean. Medium to heavy windfall existed over the whole area.

LOGGING CHANCE:

Except for dense immature stands containing a high volume in small diameter classes, the logging chance was directly proportional to volume production. By types this is shown below:

Type	Logging Chance
S-V-D	Excellent
S-V-C	Good - very good
S-V-B	Fair - good
R & S-IV-C) R & S-IV-B)	Fair

By area this may be expressed

Good - very good	15% of area
Fair - good	50%
Fair	20%
Poor	5%

MISCELLANEOUS TYPES:

Alpine Types: Tree line occurred at 7500'. Limited areas at this elevation showed variations from standard types.

High plateaux e.g. Southeast of Gould Dome supported thicket-like growth of pinus albicolis and flexilis mixed with Alpine fir. The height of these stands seldom exceeded 12-15' and a very

even canopy was formed. Diameters were not greater than 4" DBH. Foliage was brilliant and vigor appeared to be very high.

Tree-line growth on upper slopes was fringed with pure stands of Larix Lyalli growing to diameters of 18". Here again growth appeared to be vigorous. Limited quantities of this species were found close to the Divide in the West Dutch Block.

Neither of these types have any value other than as protection forest.

BURNS:

Approximately 4000 acres or 8% of the Dutch Creek area consists of burned-over land in various stages of rehabilitation. 90% of these areas occur in the South Racehorse Block.

Unlike burned-over areas lying east of Dutch Creek which have reverted to grassland, they rapidly restock with pine. Small patches of poplar also occur.

ADDITIONAL SPECIES:

Small quantities of Douglas Fir and Thuja plicata were occasionally found.

GENERAL

On the basis of the theory of species succession briefly outlined above, a detailed examination was made in a "transition type" to determine the cycle of events leading to the establishment of a climatic stand type. The examination was made in type No. 12 in the East Dutch Block classified as P-111-A, that is, an immature pine stand.

The pine content of the stand consisted of vigorous young trees whose ages deviated little from 75 years and was clearly an even-aged stand. Diameters varied from 6" DBH to 13" DBH. Beneath the pine a fairly dense understory of spruce was well established whose ages on examination showed two distinct classes at 48 years and 65 years. This was irrespective of diameter class which varied from 3" DBH to 12" DBH in both age classes. Furthermore the trees in the older age class were poorly developed and showed incipient butt-rot, whereas the growth in the younger class was vigorous.

In addition to these two predominant species and age classes, large mature spruce trees up to 30" DBH and 200 years were scattered throughout the stand. There were about 20 of these trees to the acre. On the ground as windfalls were remnants of a previous pine crop fairly well preserved and when bored showing an age of 70 years. Finally, badly decayed butts just recognizable as spruce were also present in a half-buried condition.

A reconstruction of stand history illustrates the following sequence of events.

A mature or overmature spruce stand (S-type) is subjected to a highly destructive fire. A few trees may escape, These would be vigorous middle-aged stems say 50-100 years old

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[illegible]

[illegible]

since young trees would perish from scorch and mature or over-mature trees would almost certainly suffer windfall as a consequence of the drastic thinning.

Resultant on the fire a dense young pine stand is established, thins itself out, regenerates itself at approximately 70 years and dies, succeeded by a second generation of young pine. This second crop becomes established but is now mixed with young spruce seeded from residual spruce stand, and thriving on the fire-disturbed soil plus the litter from the first generation of pine. The spruce is established in a comparatively short period but is not very dense owing to the limited number of spruce trees. The second pine generation is also very even-aged.

16 or 17 years later another heavy seed crop is produced by the residual spruce stand and a cousin generation of spruce again establishes itself in the stand openings not previously seeded. At this stage however the soil and environmental conditions are much more suited to spruce, the original site having been ameliorated by the first spruce generation so that greater shade and heavier ground cover exist. Consequently growth is more vigorous, cull is absent and increment high. The following figures clarify this:

Crop	Age	Mean Annual Diameter Increment	Vigor
1st. generation Spruce	210	.32 in	Good
1st. generation Pine	70	.58 in	Good
2nd. generation Pine	70	.36 in	Fair
2nd. generation Spruce(1st.seeding)	65	.20 in	Poor
2nd generation Spruce(2nd.seeding)	48	.50 in	High

It would seem that this point appears to be the climax in the evolution of a good spruce site. Degeneration of the site as the spruce content increases and matures is accompanied by fir invasion and diminishing spruce regeneration. This latter condition is prevalent throughout the whole of the Dutch Creek Area. Pine regeneration was rare confirming the limit of two generations in this species. The following measurements taken in a mature spruce stand give some comparison:

Species	DBH	Age	Mean Annual Diameter Increment
SW	4.4	80	.055 in.
SW	6.6	120	.055 in.
SW	7.8	150	.052 in.
SW	9.0	210	.043 in.
SW	15.6	390	.040 in.

It is seen from the above analysis that reseeding of the area depends on the escape of a few trees in the original spruce stand. In a highly destructive fire it is possible that no trees would survive. Here an examination of the first phase of the cycle i.e. a restocking burn gave the key to spruce regeneration. This area was burned in 1936 and since a large number of standing firekilled trees were still present, it was possible to classify the original stand as an S-IV-B type. Destruction in this case was 100%. Restocking was

rapid and dense young pine now covers the area, density ranging from 3000-5000 trees per acre. Scattered among the pine, spruce seedlings were present to estimated extent of 1000 per acre in some places and non-existent in others. Douglas Fir regeneration was entirely absent. Examination revealed that spruce regeneration was proportional to (1) The density of the young pine (2) The seeding distance from the mature marginal spruce stands which had been left intact. This seldom exceeded 300'.

In either of the two cases cited above the following sylvicultural requirements for spruce regeneration under these conditions emerge.

(1) The provision of modified site shade and protection. Pine appears to be a very suitable nurse crop to spruce.

(2) The existence of sufficient seed trees within seeding range.

(3) The subsequent modification of site condition as achieved in the first case by a pioneer spruce generation.

CONCLUSIONS:

The foregoing detailed sylvicultural analysis has been made in order to determine the factors influencing growth of the major species, i.e. spruce with a view to prescribing correct sylvicultural treatment in the logging plan.

Three Principal points have emerged:

(1) Spruce regeneration, while successful and vigorous in pine stands is decadent or non-existent under an overstory of its own species.

(2) The irregular distribution of age-classes is attributable to fire followed by limited seeding.

(3) Low increment in suppressed stems does not apparently impair growth after release.

It has been stated previously that some agency within the mature spruce stand precluded regeneration after a certain period, in most cases 100-150 years, after stand establishment. Comparison of the pine stand, such as the case in point and a mature spruce type immediately reveals two obvious differences:

(1) A greater quantity of light penetrates the pine canopy, a camera light meter showed a range of 5-7 in the latter while a reading of 3-5 was obtained under spruce.

(2)The ground and soil under pine is clean of all raw humus formation and dense, choking moss cover whereas in spruce the reverse is the case.

Less obvious is the decreased competition offered to young spruce by the deep taproot system of pine, whereas the shallow panlike roots of mature spruce drain the surface soil on which the smaller trees depend.

As the pure spruce stand establishes denser growth on the site, so these conditions are exacerbated to the extent where insufficient light and heat can penetrate the canopy to aid the decomposition of vegatable matter on the forest floor.

After the establishment of such a stand, reseeding from the mature trees results in regeneration diminishing in successful survival as the stand closes and the severity of the conditions described above increases. The thickening humus layer prevents the delicate seedling rootlet from penetrating the mineral soil from which it will draw sustenance after seed reserves are exhausted. The root and light competition prevents proper crown development, the young tree becomes sickly and a prey to insect and fungal attack. When these conditions are further enhanced even successful germination is prevented. Fir, however, being more tolerant and possessing a deeper root system will survive until it comprises almost 100% of the entire regeneration, as is the case in the Dutch Creek Area. At the extreme of this development the forest floor is strewn with windfall and other vegetable refuse and a high fire hazard is constituted. Incidental lightning strikes no longer cause spot burns but will, during an exceptionally dry season, cause a major fire resulting in almost complete destruction. This marks the end of one cycle and the beginning of another with the establishment of young pine. The ultimate phase of this cycle, if it ever occurs, is not clear. The fact that the age of some spruce trees has been recorded at 490 years indicates that, unless disturbed, most of this species might persist to the same age, whereas very few trees have been found to exceed 300 years. This indicates that the present fire-free cycle, at least is nearing its close. There is very strong evidence that fire plays an integral part in the regeneration of spruce stands. Certainly the lack of regeneration in these stands does not indicate any preparation on the part of the species to perpetuate itself. Fir regeneration is prolific but the logical deduction of a pure fir over-story is not evident in any save small patches.

It has been seen that the initial even-aged result of fire has been modified to some extent by the ecological characteristics of the species. An all-age condition is eminently suited to spruce and a vestigial attempt has been made to supply the lower age classes. It is hardly likely that a self-destructive influence is inherent in spruce stands, admittedly a climatic type. It may, therefore, be inferred that given a sufficient fire-free period, spruce would naturally develop a normal selection forest with all ages present. This is extremely important from both the sylvicultural and protection aspect and its significence is explained later. It has also been seen that spruce shows enormous powers of recovery after release from suppression. Extreme suppression is not characteristic of a tolerant species such as spruce and it may again be inferred that this unnatural condition is attributable to fire.

Certain sylvicultural measures have now become apparent. Taking it for granted that a sufficient fire-free period can be maintained.

(1) Spruce regeneration must be established as soon as possible.
This entails: 1. Opening up the stand to an extent where sufficient heat and light may enter, yet providing sufficient shelter for regeneration.
2. Breaking up the raw humus layer by natural (as above) or if necessary artificial means e.g. brush burning, skidding etc.
3. Provision of sufficient seed trees within seeding range.

(2) Suppressed stems must be released to allow increment growth. This will be effected by sufficient stand thinning.

(3) The forest must be assisted to establish a normal all-age selection condition suited both to spruce and mountainous regions.

GROUND COVER:

A list of herbaceous plants and mosses most commonly found in the area is given in Appendix V.

Ground cover in the Dutch Creek Area varied considerably according to the Cover Type. Thus Pine stands were poor in herbaceous cover supporting only pine grass, fireweed, paint-brush, the latter two in small quantities - and moss. Burns were profuse with fireweed and in some areas alder on north slopes. Cover grew most abundantly under light spruce stands in small openings on moist soil. Dense snowberry cover was characteristic of slopes with a north aspect and seldom grew on sites facing south. This shrub often grew waist high under open spruce stands completely obscuring the ground.

Alpine types supported a large variety of flowering perennials e.g. glacier lily, dogwood, and ferns which made their appearance at high altitudes. Rock slides at high elevation as at the head of Dutch Creek support saxifragaceous species.

Wet meadows, profuse in the whole area supported sages, a variety of sweet grasses and a thin moss cover. Little true muskeg was found and no sphagnum moss-hummock formation encountered.

[illegible]

[illegible]

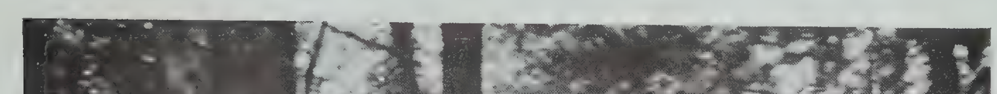
[illegible]

[illegible]

[illegible]

[illegible]

Typical Damp Meadows on Dutch Creek.



Young Spruce coming in under a Pine Overstory.

Burned-over areas at high altitude e.g. Grassy Ridge supported good growth of wild rye, lower slopes bearing only pine grass.

Tree climbing shrugs were not profuse and tree moss was not encountered in any quantity. Lichens were fairly plentiful, particularly in areas with rock outcrop. Fungi were plentiful under spruce stands, but few of the bracket variety were found on trees.

Dense cover in most spruce stands suppressed profuse growth of herbaceous plants. Where the stand had opened up on the north side, dense snowberry growth exercised the same effect. Only in Alpine types close to springs was to be found any great quantity of flowering plants.

EXPLOITATION FACILITIES:

The long axis of the area which runs north and south presupposes the necessity for a major transportation artery following the same direction. It is assumed that the Trunk road will provide this outlet, funnelling most products through Coleman (See Geographical location). Subsequent major haul routes lie along Dutch, Racehorse and Vicary Creeks, in the latter case branching twice, once at the Forks and again more centrally in the area as shown on the map. This entails the construction of many miles of all-weather road. The sequence of construction would naturally depend on the order in which the individual blocks were exploited.

The Allison Creek Prop Road which serves the southern part of South Racehorse Block will be a useful link with Coleman 17 miles southeast. This road is in poor repair at present and would require repair.

From the principal network, secondary routes follow up the larger tributaries, north Dutch Creek and the major tributaries of Racehorse Creeks. Road building is possible in all these locations. If West Dutch and North Racehorse Blocks were to be logged as a unit the construction of a major haul road following the Livingstone District Mountain trail over the height of land would be a valuable adjunct.

The construction of skid roads would depend largely on the type of exploitation to be used. Present Alberta methods using horse or power skidding will require a very considerable skid road construction. On the other hand it is doubtful whether the areas of larger timber are concentrated sufficiently to justify an adaptation of high lead system. Chutes may be used with advantage on the steepest slopes.

Whatever method is used will depend primarily on the sound construction of major haul roads, surveyed and built to specification. It is not anticipated that the complete network will be constructed at once but the major roads will extend as logging progresses according to a laid-down plan. This plan should be properly prepared and made available for departmental scrutiny and approval. Building poor roads into a heavily timbered area and vice versa is an important ingredient of bankruptcy.

ESTIMATE:

Photographic interpretation accompanied by selective sample was the basis of the estimation of timber volumes in the Dutch Creek Area.

A selection of suitable type criteria was made as explained under Sylvicultural Conditions. The exclusive presence of the three major species, Spruce, Pine and Balsam made the system chosen eminently applicable.

Typing and photo interpretation was done both in the office and field and a large number of types studied on the ground. Unfortunately the quality of the photographs taken at a scale 1": 2640' was not high enough to allow all photographic work to be completed before the cruising party entered the field. Subsequent ground checking took up more time than should be necessary.

As far as possible, representative types in each class were selected and cruised by the strip method endeavoring to weigh samples in proportion to the frequency of the type. The frequency is shown below:

Ratio of Sampling		Proportion of Types Present
S - Types	65%	44%
R - Types	24%	29%
Q - Types	8%	19%
P - Types	3%	8%

It is seen that S - Types were sampled heavily at the expense of Q - R Types. Since the former contain a large part of the merchantable timber this was justified. Very dominant types e.g. S-IV-B; S-IV-C were also sampled heavily.

The strip method was chosen in preference to the plot since it averages growth conditions which vary with elevation and local site conditions (draws, moist locations). Significant variations in growth were inevitable in large types resulting from a broad classification. A finer system of typing would have been unjustified both in time and accuracy.

The tally was recorded for each species down to 4" DBH. although volume calculations were only carried down to 7" DBH., the additional time spent in tallying the additional diameter classes was insignificant compared to the information acquired. Light taper measurements and age borings were taken at mechanical frequency and field checks on Site, regeneration, soil, vigor, disease, insects etc., were made and the information entered on a separate sheet. This information is shown in Appendix XI. All strips were marked and blazed in the field and their locations accurately marked on the aerial photographs.

38 strips were cruised, each strip had two or four legs, each leg varying from 10 chains to 40 chains according to the sample required. Comparison between individual tallies in the same type was therefore possible to determine the accuracy of typing.

Sufficient height and density calculations were made in the field to allot a height density class, to each type (see Sylvicultural Conditions) and to construct height diameter curves for each height class.

Height diameter curves were constructed for Spruce height classes IV and V, Pine and Balsam.

14 Spruce trees were then felled and accurately scaled to compare volumes given in Dominion Form Class volume Tables with actual volumes. The difference was found to be less than 1%. Accordingly volume tables were constructed from the former tables for each of the following species:

SW-V, SW IV; Pl; Fb (See Appendix VII) volumes were then entered on tally sheets and the percentage composition class determined and allotted to each type. Thus the type symbol was complete.

On return to the office, data from tally sheets in similar types were averaged to obtain Stand Tables, which are given in Appendix VI. The averaged volumes were then applied to their respective types over the whole area. These calculations are shown in the compilation sheets (Appendix IX).

Mapping was carried out exclusively from aerial photographs where coverage was obtained. The radial line plot system with multiple ground control stations minimized error. In the absence of a mechanical device, detail was traced on to the map. (Bridgeland's)

Areas of types were then planimetered and entered on the Compilation Sheet to allow final computation of total volumes in each type. In mapping, the topography was corrected wherever errors appeared in the map. Type areas and volumes by species were then entered on the Type map.

Volume calculations were made by individual blocks. Total figures obtained are summarized below. Estimate of merchantable volume was dependent on the sylvicultural and protection interests of the forest. Protection areas were delineated and their volume segregated from the remaining stock. This was also done in the case of types withheld from removal on sylvicultural grounds. These included all immature and pure pine types (see conditions of cutting) and were as follows:

S-111-B; R-111-B; Q-111-B; P-111-A; P-IV-B.

The recommended diameter limit of 13" DBH, was then applied and each stand reclassed into merchantable and unmerchantable timber. This was expressed as a percentage by volume and it is of interest to compare figures for each type:

Type	%Merchantability by Volume	Type	%Merchantability by Volume
S-V-D	66.0	R-V-C	62.6
S-V-C	78.6	R-V-B	69.0
S-V-B	80.3	R-IV-C	50.2
S-IV-C	65.3	R-IV-B	42.6
S-IV-B	58.9	Q-IV-C	38.7
		Q-IV-B	31.7

"ERROR"

Owing to the impracticability of cruising more then 1% of the ground by area, other means of securing accuracy had to be devised. The division of the timber as a whole into 16 types and the choice of representative areas in each of these types from examination of aerial photographs obviated the necessity for a large number of mechanically spaced strips.

However, since the selection of cruise-lines depended only on visual comparison on the photographs, it was necessary to check the accuracy of interpretation and selection by calculating the Standard Deviation, first between different samples within similar types, and then between individual tallies in the same sample.

Since classification of the types was by 25% divisions in both Cover-Type and Density and 20% divisions of Height Class it was necessary that the Standard Deviation for individual samples did not exceed the former figures.

Calculation of Standard Error, as shown in Appendix 10 showed the average error to be 21% in the case of types and 13% in the case of individual tallies.

The falling percentage of timber to be removed proportional to decreasing volume is in order with a policy of lower cutting in poorer stands.

The separation of merchantable and unmerchantable volume by blocks is given below:

Block	Merchantable MFBM	%	Unmerchantable MFBM	%
Vicary	32,663	54	27,553	46
S. Racehorse	61,811	47	69,894	53
N. Racehorse	68,736	51	66,743	49
E. Dutch	111,285	51	108,395	49
W. Dutch	82,183	43	109,264	57
Total	356,678	48	381,849	52

Cutting then will remove approximately 50% by volume over the whole area. Approximately, Spruce will comprise 75%, Pine 20% and Fir 5% by volume.

The unmerchantable part of course included both protection and immature stands. A complete breakdown is given in Appendix I.

CONDITIONS OF CUTTING:

Choice of a correct sylvicultural system will depend on factors enumerated under "Sylvicultural Conditions" plus any properties peculiar to local conditions. The highly erodible nature of the Dutch Creek Area emphasized the need for continued protection.

Clear cutting or modifications thereof would satisfy three sylvicultural conditions i.e. break-up of raw humus material. Regeneration would be fostered to a degree under a shelterwood modification. Protection from wind and insect ravage could be obtained by a staggered cut. On two major counts however the system is inapplicable, that of watershed protection and also, as seen under increment, the premature felling of apparently over-mature small diameter trees would constitute an unjustifiable distinction of stems capable of greater increment growth as conditions permit.

In considering a partial or selection cut system it must be understood that two indispensible conditions of the system are to some extent self-opposing that of opening up the stand to allow both regeneration and increment to expand against that of maintaining a fairly close canopy and sufficient trees for future increment growth.

In all other respects the system is ideally suitable. The problem is reduced to how many and what trees may be conveniently removed to satisfy both these conditions.

Regeneration and increment are adversely affected by the presence of the larger diameters, the former because large trees suppress young growth, while the smaller diameters provide necessary protection, and the latter because the smaller diameters are the potential increment producers being suppressed by their dominant fellows. If 12"DBH, is accepted as a suitable division between the two classes, then the removal of all stems above this diameter will satisfy both requirements. It has been seen that the majority of all diameters fall in this class indicating a site growth relationship.

Application of this division to representative types produces the following distribution:

4 - 12"		DBH	13"	DBH	Plus	
Stems Per acre		Volume Per acre	Stems per Acre	%	Volume Per Acre	%
S-V-C	267	5760	78	24	21085	78
S-IV-C	320	7650	70	18	14385	65
S-IV-B	315	5600	35	10	8030	59
R-IV-B	393	7830	27	6	5820	73

This cut then meets the two requirements. It is sylviculturally correct that the preponderance of small diameters should remain in the stand to put on increment while the large obstructive stems are removed. This state of affairs however is complicated by the fact that it is a few trees in the larger diameters which are responsible for a large portion of the current increment and that the immediate felling of these would greatly reduce stand increment in the interval before the release of the suppressed classes was effected. It would not be economically justifiable to cut the trees at the height of their growth. Furthermore such trees have a direct effect on regeneration. Greater diameter growth results in greater height growth. Such trees projecting above the canopy have greater wind-firmness, well-developed crowns and a higher seed production.

It is proposed then that the forester on the ground should be given a free hand in selecting such trees and marking them for retention over a period. They should be well distributed about the area and their number should be increased in proportion to the volume of the stand. Comparison of figures in the above table indicates that if a greater number of trees should be retained in the S-V-D Class diminishing with less productive types, not only would additional increment be obtained in such heavy stands, but danger from windfall would be mitigated.

Protection should also be a factor in selecting trees to remain. More trees should be retained on steep slopes and ridges than on less erodible sites. A suggested distribution of marked trees is shown below:

Total Volume Production	Steep Terrain Stems per Acre	Level or gentle terrain Stems per Acre
30 MFBM p.a. plus	35	25
20 - 30	20	15
10 - 20	15	10

The production from these trees 6f course would not be lost. After their purpose had been served, i.e. regeneration established, increment from suppressed stems increasing, they should be cut.

In this way the rigidity of a selection cut based on diameter without reference to vigor may be made more flexible, while the cost of marking under conditions to be discussed will not exceed the value of such action.

Following such cuttings, regeneration will only come in if the second requirement is met, that is if the ground and soil are in a suitable condition. It has been seen that disturbance of raw humus and exposure of the mineral soil is the limiting factor. Brush burning will assist this to a certain extent as will such operations as felling and skidding. The co-operation of the operator in this case would be indispensible and his willingness to experiment in various methods of brush disposal, extended skidding etc., may mean the success of the plan.

Consideration has also been given to the protection interests of the forest. Areas where erosion is either present or likely have been segregated from the cutting areas and will not be operated on until the effects of logging on less steep sites are known. The majority of these areas occur along the divide. It is obvious however that the effect of wind in stands thinned 24% will be extensive and some measure must be devised in addition to previous recommendations. Rather than modify the cutting plan with ensuing detriment to regeneration and increment it is proposed to introduce protective practices other than a lighter cut.

It is recommended that the area be logged by staggered cuts so that no two recently cut-over areas will be adjacent. This entails the subdivision of the whole into areas small enough to have protective value and large enough for convenient logging. The size of each block will have to be determined by experiment. It is suggested however that 25 acres should be used to start with. If each area can be extended without impairment to the stand greater logging covenience will result. It will not be advisable to exceed 40 acres. The long axis of each block should run at right angles to the prevailing winds i.e. north, south and should be at least twice the width, 500 yards by 200 yards would be ideal. No two adjacent areas should be logged within 5 years of each other. This means, of course that the whole area will have to be covered more than one during the period of the sale. This however merely means that complete exploitation facilities will have to be constructed during the first part of the sale period instead of progessively as when cutting is out of face. As far as possible the boundaries of each block should be marked by natural features but small excesses on the part of the operation have no significance.

Complete subdivision of the area at once should not be undertaken except on a map. The logical direction for the progression of cutting should not be altered and only blocks to be logged in the current season should be defined on the ground. Similarly, marking of trees to be retained should only be carried out in the anticipated logging area.

Once the blocks have been laid off for logging they should be given a number to indicate their sequence. A check on the operator's capacity and the volume contained in each block will determine the number to be covered in the current season.

These recommendations primarily apply to spruce as the major species. Pine however is also given recognition for the part it plays in the evolution of such stands and pure pine stands will be protected notwithstanding the possibility of patches of pure pine regeneration coming in. Where such conditions exist, the ultimate spruce regeneration is apparently assured. Similarily no mature spruce will be cut where it exists in small patches in young pine since these trees form the nucleus for seeding future spruce stands. Immature stands of any composition of course will not be logged, these are all in the 111. or 40' - 60' height class.

Depending on seed and climatic conditions, regeneration should come in the second spring following the cut and should be complete within 5 years. In some places it will be more rapid, in others the regeneration period may extend to 6 or 7 years. Where regeneration is slow due to insufficient light penetrating the canopy, additional mature trees, as prescribed by the Forest Officer, will have to be removed. This would be accomplished either by allowing some marked stems to be removed or by a temporary reduction in the diameter limit.

The establishment of widespread regeneration will fill up the missing age classes from 1-10 years, but the gap between 10 and 100 years will still interrupt the normality of the forest. Future increment from the smaller stems may be reasonably expected to provide for a further cut of 30 years which will extend the normality to age classes 1 to 50.

Hereafter no further cut can take place until the age classes regenerated in the present sale period have reached maturity. There is ample evidence that spruce growing on revitalized sites will reach merchantable diameters in 100 years and since a reduction of rotation is in accordance with improved management this figure should be accepted as an ideal even if it is not achieved in practice.

After one rotation, the condition of the whole forest should approach normality and further cuts may be made from increment only, thus conforming with ideal sylvicultural practice.

It is seen then that this management plan hinges on three principles:

(1) The rapid establishment of regeneration.
(2) The preservation of stems whose greatest increment growth is yet to come.
(3) The reduction of the rotation. Practical measures to achieve this plan are put forward under "Recommendation."

ADDITIONAL INFORMATION:

The foregoing recommendations have been made in the light of available facts. However, logical deductions do not always follow natural vagaries. The possibility of failure to obtain adequate regeneration, though slight, must not be denied. It is possible that an all-aged condition is unsuited to spruce and that even-aged regeneration by fire is the only means of establishing this species in pure stands.

Should this be found to be the case, the principles of the plan will still be good. Regeneration by blocks and provision of seed trees are cardinal points of a modified clear cutting system. The difference would tie in the necessity for removal of the balance of the stand in an additional cut. This could be included in the same sale or made into an additional one.

However this possibility is not contemplated and all means to establish a selection forest should be tried before deciding the system is unsuitable.

This report lays down the principles but not the fine detail of the prescribed treatment. Suggestions and proposals are made,

but the final practical measures are the responsibility of the Forest Officer on the spot and he should be given the greatest freedom within the general framework. Such matters as selection of marked trees, location of logging blocks and sequence of cutting are matters which must be decided in the light of local knowledge.

RECOMMENDATIONS:

The application of any sylvicultural system, however foolproof, to 85 square miles of highly erodible territory without prior trial would be highly inadvisable.

Fortunately a test case is available in the Vicary Block the smallest of the watersheds 4,000 acres in extent and containing 32.6 million feet of merchantable timber. The area is readily accessible by means of a first class road which cuts through the eastern tip of the block. It is compact and a good logging proposition. If the recommended plan is generally successful, particularly in the matter of spruce regeneration, the other blocks should be prepared for sale, since similar conditions obtain. The test period should not exceed two years.

It is therefore recommended that:

(1) The Vicary Block being the watershed of Vicary Creek, comprising 4,633 acres and containing approximately 32.6 million board feet shall be offered for sale for logging.

(2) The diameter limit for cutting shall be 13" DBH or 14" on the stump 12" from the ground.

(3) Logging shall be carried out strictly in accordance with the logging plan prepared by the Department.

(4) Certain trees marked for retention by the forest officer in charge shall not be cut.

(5) Certain trees marked for removal on sylvicultural grounds by the forest officer shall be cut.

(6) Disposal of brush shall be by piling and burning.

(7) A plan showing the proposed network of principal logging roads with specifications shall be submitted for Departmental scrutiny and approval, before such roads may be constructed.

(8) The successful operator be allowed use of the Forestry Trunk Road and in view of the excellent transport facilities, the regulation rate of dues shall apply.

(9) The period allowed to complete (cutting) shall be 15 years.

APPENDIX II

LEGAL DESCRIPTION:

In Township 9, Range 4, West of the 5th Meridian.

Secs. 18, 19, 20, 30 & 31.
LSDs. 14 and 15 of Sec. 8.
Sec. 17, less LSD. 1.
LSDs. 4, 5, 12, 13 of Sec. 21.
LSD. 4 of Sec. 28.
LSD. 4 of Sec. 32.
LSDs. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13 of Sec. 29.

In Township 9, Range 5, West of the 5th Meridian.

Secs. 13, 22, 23, 24, 25, 26, 27, 28, 34, 35 & 36.
Sec. 14 less LSD 4.
Sec. 15 less LSDs. 1, 2, 3, 4, 5, 6, 12 & 13.
LSDs. 12, 13, 14 of Sec. 16.
LSDs. 9 and 16 of Sec. 17.
LSDs. 1, 8, 9, 15 & 16 of Sec. 20.
Sec. 21, less LSDs. 1, 2 & 8.
LSDs. 1, 2, 7, 8, 9, 10 of Sec. 29.
Sec. 33 less LSDs. 4 & 5.
LSD. 16 of Sec. 32.

In Township 10, Range 4, West of the 5th Meridian.

Secs. 5, 6, 7, 8 & 31.
LSDs. 4, 5, 6, 11, 12, 13, 14 of Sec. 9.
Sec. 18 less LSDs. 15 & 16.
Sec. 17 less LSDs. 13, 14 , 15 & 16.
LSDs. 5, 6, 11, 12 of Sec. 16.
LSDs. 10, 11, 12, 13, 14, 15 of Sec. 19.
Sec. 30 less LSD. 1.
LSDs. 12, 13, 14 in Sec. 29.
Sec. 32 less LSDs. 1, 2 & 8.

In Township 10, Range 5, West of the 5th Meridian.

Secs. 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 25,
26, 27, 28, 29, 32, 33, 34, 35 & 36.
Sec. 24 less LSDs. 1, 2, 7 & 8.
LSDs. 1, 8, 9, 16 of Sec. 5.
LSDs. 1, 8, 9, 10, 15, 16 of Sec. 8.
$E\frac{1}{2}$ of Sec. 17.
$E\frac{1}{2}$ and LSDs. 3, 6, 11, 12, 13, 14 of Sec. 20.
LSDs. 1, 8, 9, 16 of Sec. 30.
LSDs. 1, 2, 7, 8, 9, 10, 11, 14, 15, 16 of Sec. 31.

In Township 11, Range 4, West of the 5th Meridian.

Secs. 5, 6 & 7.
LSDs. 13, 14, 15 of Sec. 3.
Sec. 4 less LSDs. 1, 2 & 8.
LSDs. 5, 12 of Sec. 11.
Sec. 10 less LSDs. 13, 14, 15,& 16.
Sec. 9 less LSDs. 13, 14, 15 & 16.

Sec. 8 less LSDs. 14, 15 & 16.
LSDs. 1, 2, 3, 4, 5, 6, 7, of Sec. 18.
LSDs. 4, 5, 6, 10, 11, 12, 13, 14, 15 of Sec. 30.
LSDs. 2, 3, 4, 5,6,7, 10, 11, 12, 13, 14, 15 of Sec. 31.

In Township 11, Range 5, West of the 5th Meridian.

Sec. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15, 17, 18, 19, 22, 23, 25, 26, 27, 31, 33, 34, 35 & 36.
Sec. 6 less LSDs. 4 & 5.
Sec. 13 less LSDs. 9, 10, 15 & 16.
Sec. 24, less LSDs. 1, 2, 7, 8 & 9.
LSD.s. 1, 2, 3, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16 of Sec. 21.
Sec. 16 less LSDs. 11, 13 & 14.
LSD.s. 3, 4, 5, 6, 11, 12, 13 of Sec. 20.
Sec. 28 less LSD. 5.
LSDs. 1, 2, 7, 8, 9, 10, 11, 14, 15, 16 of Sec. 32.
Sec. 30 less LSDs. 9 & 16.

In Township 11, Range 6, West of the 5th Meridian.

LSD. 16 of Sec. 1.
LSDs. 1, 8, 9, 16 of Sec. 12.
LSDs. 1, 7, 8, 9, 10, 15, 16 of Sec. 13.
E.½ of Sec. 24.
LSDs. 1, 2, 7, 8, 9, 10, 16 of Sec. 25.
LSD. 1 of Sec. 36.

In Township 12, Range 4, West of the 5th Meridian.

LSDs. 2, 3, 4, 5, 6 of Sec. 6.

In Township 12, Range 5, West of the 5th Meridian.

LSDs. 1, 2, 3, 4, 5, 6, 7, 8 of Sec. 1.
LSD. 1 of Sec. 2.
LSDs. 1, 2, 3, 4, 6, 7, 8, 9, 10, 11 of Sec. 3.
LSD. 1 of Sec. 4.
LSDs. 1, 2, 3 of Sec. 5.
Sec. 6 less LSDs. 5, 9, 12, 13, 14, 15 & 16.

APPENDIX III

LEASES & LAND ALIENATION:

Lease No.	Legal Description Twp. 9, Rge. 4. W.5th M.	Lessee
5797	NW¼ Sec. 17.	H. A. Howard
5792	LSDs. 10 & 15, Sec. 17.	H. J. Howard
5800	SE¼ Sec. 17.	H. A. Howard
5782	E½ of E½ of Sec. 19.	MacGillvray Creek Coal Co.
5799	NW¼ Sec. 20.	H. A. Howard
5798	SW¼ Sec. 20.	H. A. Howard
5780	SE¼ Sec. 29.	MacGillvray Creek Coal Co.
5781	NE¼ Sec. 29.	MacGillvray Creek Coal Co.
5735	W½ Sec. 29.	MacGillvray Creek Coal Co.
5779	E½ of E½ of Sec. 30.	MacGillvray Creek Coal Co.
5673	NE¼, LSs 7 & 8, N½ LSs. 1 & 2, NE¼ LS. 3, E½ of LSs. 6, 11, 14 of Sec.8.	H. A. Howard

Township 10, Range 4, West of the 5th Meridian.

5783	SW¼ of Sec. 8.	H. A. Howard
5795	W½ of E½ of Sec. 5.	H. A. Howard
5796	E½ of W½ of Sec. 5.	H. A. Howard
5788	SE¼ Sec. 8.	H. A. Howard
5790	NW¼ Sec. 8.	H. A. Howard
5789	NE¼ Sec. 8.	H. A. Howard
5787	SW¼ Sec. 17.	H. A. Howard
5786	NW¼ Sec. 17.	H. A. Howard
5785	NE¼ Sec. 18.	H. A. Howard
5784	SE¼ Sec. 18.	H. A. Howard

APPENDIX IV

SYLVICULTURAL CHARACTERISTICS OF MAJOR STAND TYPES IN DUTCH CREEK AREA.

Information and figures are tabulated in Stand Tables which appear in Appendix VI.

S TYPES: (75% or more Spruce - Fir Volume Content)

S - V - D: This was the best site found, yielding a total volume of 35,410 FBM per acre. Average height was 86', but trees over 115' were measured. The average diameter was 14.4" DBH, maximum tallied 28". This type was localized to a few areas only and was found on gently sloping ground such as was found in the Upper Dutch Creek Basin. Tree vigor appeared to be good and few dying trees were evident. Consequently windfall was also light. Stems per acre 390.

The stand gave an appearance of great evenness both in diameter size and height. 80% of the volume came from the 10" - 18" DBH Class. The admixtures of other species was small amounting to 3% only.

Regeneration was confined to balsam where 1,800 young plants per acre were tallied. Brush was fairly heavy due to the comparative openness of the stand. Cull was limited to 6%. Both disease and insect infestation was light. The average age of the stand is 260 years which is less than that found on poorer sites. The best logging chance was found in this area.

S - V - C)
S - V - B)

The next best site was found in these two types whose only valiant is density. They represent a degeneration of the S-V-D type due to senile decadence. Height growth is approximately the same as no further increment has taken place. Average diameter 14.2" DBH has fallen due to the death of the larger trees. Windfall is medium heavy as is brush. The number of stems per acre has decreased to 285 due to the same cause.

As to the expected regeneration it has increased both in quantity and vigor. In addition to Fir seedlings, spruce has also made an appearance in limited quantities.

FB	1,500 per acre.
SW	800 per acre.

The appearance of the stand is naturally very broken, large stems standing amongst thickets of regeneration up to 10' high.

The insect population has increased noticeably particularly the bark beetle and vigor is low. A good logging chance is still present in these type stands as a fair number of large stems still remain. However cull has increased to 10% and logging operations will be hampered by windfall and brush.

S - IV - B)
S- IV - C O

36% of the Dutch Creek Area is covered by timber stands of these types. Consequently they were heavily sampled.

They differ from the types discussed above in that the site on which they grow is poorer. As an indication of this, average height growth has fallen to 72' while the average diameter is 12.4" DBH. Stems pere acre however are comparable to the S-V classes averaging 360 to the acre . The average age of these stands is over 200 years which is near the maximum for the site. This is evidenced by frequent heavy windfall in these areas. No further increment is likely. Sites on which these stands grow vary from lower to upper slopes and the soil consists largely of a gray clay mixed with gravel and rocky outcrops. Slopes in some cases reached 50°. Brush in all cases is medium heavy. Cull factor in this type is about 10%. Regeneration consists almost entirely of balsam which however does not form more than 5% of the cover stand by volume. Pine is present in discernable quantities though not exceeding 10% by volume. This species is localized to rises in ground or to the higher border of the type along ridges etc.

Total volume production in these types varies from 14 MFBM to 22 MFBM according to density class. The logging chance is fair though stands tend to be patchy in good timber. The general appearance of the stand is irregular , all diameter classes being found together.

Generally this timber is not better nor worse than that found in the Rocky Mountain Forest Reserves.

S - III - B:

This type represents a less nature condition of the types discussed above. It also represents high altitude stands of the same dimensions where pinus albicolis or flexilis replaces pinus contorta, and alpine fir replaces balsam. Spruce species remain the same. In the latter case, a greater density is found than in the lower stands. The age of these stands vary from 60 - 100 years less than S - IV types, and the lower density factor is due to the lack of larger-sized trees few of which exceed 15" DBH. Pine content does not exceed 10% nor balsam 1%. The latter species probably requires further time to increase. Stems per acre total 460, the majority of these being made up of the smaller diameter classes. Average height does not exceed 60' and average diameter 12" DBH. Balsam still forms the larger part of the regeneration amounting to 1,500 seedlings per acre.

The logging chance in these stands is either poor or non-existent. Many of them made up the protection forest on high slopes.

50 - 75% Spruce - Fir, balance Pine.

R - TYPES:

R - V - C)
R - lV - C)
R - 111 - B)

As explained under "Sylvicultural Characteristics" these types represent phases in the transition from fire-regenerated pine to the climatic Spruce, Fir type. Consequently it is to be expected that the spruce content of each stand varies within the arbitrary 25% composition class. In actual fact the variation of the Pine content is from 25 - 46%. Balsam is fairly constant, not exceeding 10% and falling as low as 2% again indicating lack of suitable environment for its growth. D. Fir occurs in small quantities. Most of these mixture types lie in the lV height class for although individual spruce trees attain 100' the pine average of 65' is sufficient to reduce the overall figure. Average diameters of these types center around 12.8" DBH, a figure again attributable to spruce since pine grows to smaller sizes.

The pine in these types shows signs of decadance as the stand approaches a more purely spruce content, the rotation age of pine appearing to be 200 years. Diameters in this species seldom exceed 18" DBH, whereas spruce up to 24" DBH, is found. Pine is also concentrated in the larger sizes of its diameter classes since no reproduction is taking place. Thus in the R-lV-C class pine stems under 9" account only for 8% of the total pine volume.

Pine content was also accounted for in some cases by topographic factors. Southerly slopes produce greater pine content at the upper margin of the type. The persistence of the species, after fire however, is the major determinant of its presence in Q - types.

Q - 111 - B: This is a less mature condition of Q-lV types. The pine content is fairly high 44% and the balance consists of spruce. Very small quantities of fir are present. The average age is 170 years indicating that it may take 200 years for the transition from pine to spruce to take effect. Diameters were small seldom exceeding 15" DBH. The average diameter is 11.5" DBH. Average height growth does not exceed 50'. Regeneration again consists almost entirely of balsam.

Q - TYPES: 26 - 50% Spruce, Fir, Balance Pine.

Q - IV - C)
Q - IV - B)

Q types represent an earlier phase of the natural cycle producing R types, and are also unstable mixture types. Pine content varied from 56% - 66% illustrating the latitude caused by arbitrary classification. Average height is lower in Q-IV-C type than in the R-IV-C type increasing to 71' in Q-IV-B after death of the pine, and thus lessening its diminishing influence. Diameters in Q types were also small not exceeding 21" DBH, and averaging 12" DBH. Larger diameters were accounted for by the mature pine trees. However, a greater proportion of the volume is accounted for by the smaller pine diameters which reverses the condition attained by later phase R - types. In the Q-IV-C type for example, almost 50% of the total pine volume is made up from diameters 9" DBH, and less. Balsam content averages 7% and although the regeneration of this species makes up almost the entire young growth, its quantity is noticeably less averaging 800 plants to the acre. A larger percentage of the 640 stems in the stand consists of of pine trees of smaller diameters.

Q - III - B:

This represents yet an earlier condition of the succession cycle. Pine content in the Q - III - B type rises to 73 %, the near maximum for the cover-type class. In actual fact the 17% Spruce volume is made up of trees growing in draws and moist locations which escaped the fire and remain to provide a nucleus for the future spruce crop. Diameters are small in all species, not exceeding 15" DBH. The average age is 160 years, accounted for principally by pine. The average height does not exceed 50'. At this stage the pine is showing decadence at the termination of its natural life and also through its inability to free itself from the heavy competition of its fellows. Such stands appear near derelict from the sylvicultural point of view. The logging chance is nil.

P - TYPES: (76% or more Pine by volume)

P - III - A;

This is an immature pine type. A very few pure mature pine types occur in the Dutch Creek Area, but their survival as such is the exception rather than the rule (See Sylvicultural Conditions).

This class included growth conditions ranging from fairly recently established young pine stands to stands about to disintegrate and allow spruce to take over. The reason for this is to be found in the comparatively small height increment found in pure pine stands of this condition, since average height does not exceed 50' and appears to remain close to that figure for a large

part of the stands life. Subsequent opening-up and the intrusion of spruce may have some effect on this increment. Dense young fire-regenerated stands 60-75 years old give an appearance of virility which in the course of 50 years alternates to a condition where one-third of the original 2000 stems per acre remain and the stand gives an appearance of stagnation. Diameters do not exceed 12" DBH, and 90% of the stems lie below 9". Their appearance is sickly and spindly and they support small crown which do not seem to benefit from subsequent thinning.

This evidence bears out the supposition that there are few natural pine sites in the Dutch Creek Area and that the climatic type is spruce. Since pine types are important only in what they will give place to, their poor condition and rapid decadence is a fortunate rather than an unfortunate characteristic of the species.

APPENDIX VI.

			Stand Measurement											
S - V- D														
SPECIES	%	S.P.A.[1]	Av. DIAMETER[2]	Av. Height	Age	7 - 9	10 -12	13 - 15	16 - 18	19 - 21	22 - 24	24" +	MFBM	
SW	97					2180	9185	8250	10655	3170	715	445	34.6	34,600
		390	14.4	86	260									
Pl	2					85	255	150					.5	490
Fb	1					265	55						.3	320
						2530	9495	8400	10655	3170	715	445	35.4	35,410
S - V - C														
		350	14.2	88	270									
SW	87					800	3050	5860	5815	5060	1210	1680	23.5	23,475
Pl	10					300	1010	785	475				2.6	2,570
Fb	3					400	200	200					.8	800
						1500	4260	6845	6290	5060	1210	1680	26.9	26,845
S - V - B														
SW	94	220	14.3	84	275	585	2085	2675	5380	2890	665		14.3	14.280
Pl	5						100	160		400			.7	660
Fb	1					65	155						.2	220
						650	2340	2835	5380	3290	665		15.2	15,160

1 Total stems 4" and up

2 Merchantable trees over 10" only.

Stand Measurement

STAND TABLE

SPECIES	%	S.P.A.	Av. Diameter	Av. HEIGHT	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24"-/	MFBM	Totals
S -1V - C														
		390	12.2	72	200									
SW	93					1930	4450	5880	5105	1865	735	565	20.5	20,530
Pl	4					240	530	175					.9	945
Fb	3					290	210	60					.6	560
						2460	5190	6115	5105	1865	735	565	22.0	22,035
S - 1V- B														
		350	12.6	70	240									
SW	76					1025	2530	3120	1820	1280	610		10.4	10,385
Pl	17					525	690	750	370				2.3	2,335
Fb	7					560	270	80					.9	910
						2110	3490	3950	2190	1280	610		13.6	13,630
S - 111 - B														
		460	11.9	58	180									
SW	80					1475	1860	1800	1300				6.4	6,435
Pl	9					365	350						.7	715
Fb	11					775	150						.9	925
						2615	2360	1800	1300				8.0	8,075

STAND TABLE

Stand Measurement

R - 1V - B

Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up	Total	MFBM
		420	11.6	69	195									
SW	53					1250	2105	1310	1860	390	340		7255	7.3
Pl	40					1405	2140	1225	695				5465	5.5
Fb	7					695	235						930	.9
						3350	4480	2535	2555	390	340		13,650	13.7

R - 111 - B

Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up	Total	MFBM
		350	11.5	48	170									
SW	45					1660	2080			1520			5260	5.3
Pl	44					2310	1620	260	930				5120	5.1
Fb	1					860	460						1320	1.3
						4830	4160	260	930	1520			11,700	11.7

STAND TABLE

			Stand	Measurement										
SPECIES	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10-12	13 - 15	16 - 18	10 - 21	22 - 24	24 & Up	Total	MFBM
R - V - C		342	13.0	93	220									
SW	61					430	1550	1140	4760	3760	1330		12,970	13.0
Pl	33					1320	4480	4380					10,180	10.2
Fb	6					740	660						1,400	1.4
						2490	6690	5520	4760	3760	1330		24,550	24.6
R - V - B		195	13.2	85										
SW	64					350	1320	2965	3240	1880	1485		11,240	11.2
Pl	25					515	1520	1650	585				4,270	4.3
Fb	11					1460	220	215					1,895	1.9
						2325	3060	4830	3825	1880	1485		17,405	17.4
R - 1V - C		310	12.2	75	250									
SW	62					1870	5440	2525	1235	1225			12,295	12.3
Pl	36					420	1640	2200	1440	1420			7,120	7.1
Fb	2					310	180						490	.5
						2600	7260	4725	2675	2645			19,905	19.9

STAND TABLE

P - 1V - B

			Stand	Measurement										
Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up	Total	MFBM
		620	11.5	63	205									
SW	9					170	450			900			1520	1.5
Pl	85					6760	6240	1760	580				15340	15.4
Fb	6					790	330						1112	1.1
						7720	7020	1760	580	900			17,980	18.0
P - 111 - A														
		762	10.1	51	150									
SW	10					160	130						290	.3
Pl	83					1870	620						2490	2.5
Fb	7					170								.2
						2200	750						2950	3.0

STAND TABLE

Stand Measurement

Q - 1V - C

Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up.	Total	MFBM
		680	12.0	64	105									
SW	39					500	1660	1360	640	5450			9610	9.6
Pl	55					6350	5200	2100					13650	13.6
Fb	6					940	450						1390	1.4
						7790	7310	3460	640	5450			24,650	24.6

Q - 1V - B

Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up.	Total	MFBM
		540	11.7	71	195									
SW	30					490	1660	965	1830				4945	4.9
Pl	63					4350	3790	1120	590	840			10690	10.5
Fb	7					990	250						1240	1.2
						5830	5700	2085	2420	840			16,875	16.6

Q - 111 - B

Species	%	S.P.A.	Av. Diameter	Av. Height	Age	7 - 9	10 - 12	13 - 15	16 - 18	19 - 21	22 - 24	24 & Up.	Total	MFBM
		420	11.5	48	160									
SW	17					650	1640						2290	
Pl	73					7125	2780	185					10090	
Fb	10					900	550						1450	
						8675	4970	185					13,830	

APPENDIX V11

VOLUME TABLES

D B H	SW IV	SW V	Pl.	FB.
6	10	10	20	10
7	15	15	25	15
8	20	20	35	20
9	30	35	50	25
10	45	55	60	30
11	65	80	80	45
12	90	105	100	65
13	115	125	130	85
14	140	160	160	105
15	175	205	200	
16	210	250	240	
17	255	300	290	
18	300	360	345	
19	355	410	400	
20	405	470	460	
21	475	530	525	
22	520	600	595	
23	610	665		
24	685	740		
25	765	820		
26	850	910		
27	950	1010		
28	1050	1115		
29	1160	1230		
30	1280	1330		

APPENDIX VIII

DENSITY TABLE

	AVERAGE DIAMETER								
SPA	8	9	10	11	12	13	14	15	16
25	A	A	A	A	A	A	A	A	
50	A	A	A	A	B	B	B	B	
75	A	A	B	B	B	B	B	C	
100	A	B	B	B	B	B	C	C	C
125	B	B	B	B	B	C	C	C	D
150	C	C	C	C	C	C	C	D	D
175	C	C	C	C	C	C	D	D	D
200	C	C	C	C	C	D	D	D	D
225	C	C	C	C	D	D	D	D	D
275	C	C	C	D	D	D	D	D	D
325	C	D	D	D	D	D	D	D	D
500	D	D	D	D	D	D	D	D	D

Derived from

$$\frac{D}{d} = \frac{20}{14} \times 100$$

when D = Average distance between trees
d = Average diameter

$$\frac{X}{14} \times 100 = \text{percent stocking.}$$

APPENDIX 1

DUTCH CREEK AREA

SUMMARY SHEET

BLOCK	AREA				TOTAL VOLUME				PROTECTION		UNMERCHANTABLE	MERCHANTABLE
	Timbered Area	Burned Area	Barren Area	Total Area	Spruce	Pine	Balsam	Total	FBM	Ac	FBM	FBM
Vicary	4,138	188	307	4,633	45,779,650	11,324,095	3,111,865	60,215,610	--		27,552,688	32,662,922
South Racehorse	9,905	3,713	466	14,084	79,878,695	44,571,420	7,254,515	131,704,630	14,215,335	1107	55,678,276	61,811,019
North Racehorse	9,477	--	42	9,519	88,105,280	39,057,205	8,316,215	135,478,700	6,303,965	626	60,439,042	68,735,693
East Dutch	13,872	--	333	14,205	158,927,760	49,837,500	10,915,165	219,680,425	17,456,440	1480	90,938,702	111,285,283
West Dutch	11,482	--	263	11,745	144,889,100	36,566,330	9,991,850	191,447,280	66,212,825	3122	43,050,993	82,183,462
Total	48,874	3,901	1,411		517,580,485	181,356,550	39,589,610		104,188,565	6345	277,659,701	

Total Area 54,186 acres

Total Volume 738,526,645

FBM Merchantable Volume 356,678,379

AREA SHEET

VICARY = 4,635 ac.

	Type No.	No. Dots	Unadjusted Acres	Adjusted Acres	
V	1		962	+16	978
	2	114	285	+3	288
	3	134	335	+5	338
	4	100	250	+4	254
	5		1504	+25	1529
	6	74	185	+3	188
	7	45	113	+2	115
	8	22	55	+1	56
	9	113	284	+5	289
	10	8	20		20
	11	55	132	+2	134
	12	27	68	+1	69
	13	26	65	+1	66
	14	32	80	+1	81
	15	17	42		42
	16	40	100	+2	102
	17	21	52		52
	18	13	32		32
			4,564	71	4,633

S. RACEHORSE 14,854 ac.

Type No.	No. Dots	Unadjusted Acres	Adjusted Acres	
1	37	92	+2	94
2		1564	+11	575
3	38	95	+2	97
4	18	45	+1	46
5	98	245	+5	250
6	13	32	+1	33
7	25	62	+1	63
8		880	+19	899
8 (a)	80	200	+4	204
9	14	35	+1	36
10	90	225	+5	229
11	27	68	+1	69
12	49	123	+3	126
13	154	385	+8	393
25 (a)	92	230		
14		3032	+70	3102
15	12	30	+1	31
16		872	+20	892
17	28	70	+2	72
18		552	+11	563
19	77	192	+4	196
20	64	160	+3	163
21	20	50	+1	51
22	36	90	+2	92
23	101	253	+5	258
24	71	1180	+27	207
25		874	+22	896
26	43	108	+2	110
27	45	112	+2	114
28		496	+10	506
29	84	212	+4	216
30	122	305	+6	311
31	142	356	+7	363
32	43	108	+2	110
33		772	+18	790
34	68	170	+2	172
35		1076	+27	1103
36	154	385	+8	393
37	11	28	+1	29
		14,533		14,084

E. DUTCH

	No. Dots			
1				
2	86	215	+4	219
3	71	177	+6	183
4		2346	+48	2394
5	46	115	+2	117
6	41	103	+ 2	105
7	55	138	+3	141
8	28	70	+2	72
9	129	,323	+7	330
10	109	272	+8	280

N. RACEHORSE

Type No.	No. Dots	Unadjusted Acres	Adjusted Acres	
11	11	28	+1	29
12	114	295	+6	301
13		1108	+23	1131
14		902	+20	922
15	116	255	+5	266
16		540	+11	551
17	137	342	+7	349
18	83	210	+4	214
19	92	230	+5	235
20	10	25	+1	26
21	32	80	+2	82
22	11	28	+1	29
23	49	123	+3	126
24	73	183	+4	187
25	31	78	+2	80
26	98	247	+5	252
27	28	70	+2	72
28	30	75	+2	77
29	30	75	+2	77
30		712	+14	726
31		744	+15	759
32	111	278	+6	284
33	14	35	+1	36
34		700	+14	714
35	74	185	+4	189
36	87	222	+5	227
37	56	140	-+3	143
38	102	259	+5	264
39	55	138	+3	141
40	58	145	+3	148
41	41	103	+2	105
42	186	465	+9	474
43	183	458	+9	467
44		674	-+13	687
		13,946		14,205

AREA SHEET

N. RACEHORSE

Type No.	No. Dots	Unadjusted Acres	Adjusted Acres	
1	98	245	+8	253
2	37	92	+4	96
3	60	150	+5	154
4	36	90	+4	94
5	147	368	+13	381
6	72	180	+8	188
7	16	40	+2	42
8	190	475	+20	495
9	21	53	+2	55
10	F. 153	382	+12	394
11	F. 142	355	+9	364
12	46	115	+4	119
13		3669	+121	3790
14	95	238	+9	247
15	47	117	+4	121
16	120	300	+12	312
17	58	145	+6	151
18	F. 156	390	+12	402
19	77	192	+8	200
20	74	185	+8	193
21	48	120	+4	124
22	78	195	+8	203
23	167	417	+16	433
24		624	+24	648
25	23	58	+2	60
				9519

W. DUTCH

Type No.	No. Dots	Unadjusted Acres	Adjusted Acres	
1		632	+12	644
2	22	55	+1	56
3	25	62	+1	63
4		522	+10	532
5		582	+12	594
6	48	120	+2	122
7	Missing			300
8		554	+9	563
9		566	+13	579
10	102	255	+5	260
11		4784	+94	4878
12	73	183	+4	187
13	25	62	+2	64
14	118	295	+6	301
15		760	+15	775
16		488	+10	498
17	44	110	+2	112
18	157	492	+10	508
19	26	65	+2	67
20	15	38	+1	39
21	128	220	+4	224
22	41	105	+2	107
23	44	110	+2	112
24	65	163	+3	166
		11223		11745

APPENDIX IX.

COMPILATION SHEET

BLOCK VICARY 4,763 ac.

			Per	Acre		Total	Stand				
Type No.	Type Symbol	Area	Spruce	Pine	Balsam	Spruce	Pine	Balsam	Total	Classification	Merchantable
1	S-1V-C	978	20,530	945	560	20,078,340	924,210	547,680	21,550,230	M	14,072,200
2	Q-1V-B	288	4,945	10,690	1,240	1,424,160	3,078,720	357,120	4,860,000	M	1,540,620
3	P-111-A	338	290	2,490	170	98,020	841,620	57,460	997,100	1	
4	R-1V-B	254	7,255	5,465	930	1,842,770	1,388,110	236,220	3,467,100	M	1,476,985
5	S-1V-B	1,529	10,385	2,335	910	15,878,665	3,570,215	1,391,390	20,840,270	M	12,274,937
6	Burn	188								B	
7	S-1V-C	115	20,530	945	560	2,360,950	108,675	64,400	2,534,025	M	1,654,702
8	S-1V-C	56	20,530	945	560	1,149,680	52,920	31,360	1,233,960	M	805,802
9	S-111-B	289	6,435	715	925	1,859,715	206,635	267,325	2,333,675	1	
10	∧ ∧ ∧	20								1	
11	∧ ∧ ∧	134								B	
12	∧ ⅄ ∧	69								B	
13	P-111-A	66	290	2,490	170	19,140	164,340	11,220	194,700	1	
14	P-111-A	81	290	2,490	170	23,490	201,690	13,770	238,950	1	
15	R-1V-B	42	7,255	5,465	930	304,710	229,530	39,060	572,300	M	244,226
16	R-1V-B	102	7,255	5,465	930	740,010	557,420	94,860	1,392,300	M	592,120
17	∧ ⅄ ∧	52								BP	
18	∧ ∧ ∧	32								BP	
TOTAL		4,633				45,779,650	11,324,095	3,111,865	60,215,610		32,662,922

Timber	4,138
Burn	188
Barren	307
Total	4,633

CLASSIFICATION:

M = Merchantable
1 = Unmerchantable
B = Barren
P = Protection Forest

SYMBOLS

ψ ψ	Muskeg
ψ ⅄	Treed Muskeg
∧ ∧ ∧	Barren Rock
∧ ⅄ ∧	Rock with scattered trees.

COMPILATION SHEET

BLOCK SOUTH RACEHORSE 14,084

Type No.	Type Symbol	Area	Per Acre Spruce	Per Acre Pine	Per Acre Balsam	Total Stand Spruce	Total Stand Pine	Total Stand Balsam	Total Stand Total	Classification	Merchantable
1	S-1V-B	94	10,385	2,335	910	976,190	219,490	85,540	1,281,220	M	754,627
2	P-111-A	575	290	2,490	170	166,750	1,431,750	97,750	1,696,250	1	
3	Burn	97								B	
4	Burn	46								B	
5	Q-1V-C	250	9,610	13,650	1,390	2,402,500	3,412,500	347,500	6,162,500	M	2,384,694
6	Burn	33								B	
7	S-1V-B	63	10,385	2,335	910	654,255	147,105	57,330	858,690	M	505,951
8	R-1V-B	899	7,255	5,465	930	6,522,245	4,913,035	836,070	12,271,350	M	5,227,616
8(a)	S-1V-B	204	10,385	2,335	910	2,118,540	476,340	185,640	2,780,520	M	1,637,715
9	∧ ⅄ ∧	36								BP	
10	^ ^ ^	229								BP	
11	P-111-A	69	290	2,490	170	20,010	171,810	11,730	203,550	1	
12	P-111-A	126	290	2,490	170	36,540	313,740	21,420	371,700	1	
13	P-1V-B	393	1,520	15,340	1,120	597,360	6,028,620	440,160	7,066,140	MP	
14	Burn	3,102								B	
15	S-V-B	31	14,280	660	220	442,680	20,460	6,820	469,960	M	370,183
16	P-111-A	892	290	2,490	170	258,680	2,221,080	151,640	2,631,400	1	
17	Burn	72								B	
18	R-1V-C	563	12,295	7,120	490	6,922,085	4,008,560	275,870	11,206,515	M	5,625,663
19	P-111-A	196	290	2,490	170	56,840	488,040	33,320	578,200	1	
20	R-1V-C	163	12,295	7,120	490	2,004,085	1,160,560	79,870	3,244,515	M	1,628,729
21	Q-1V-B	51	4.945	10,690	1,240	252,195	545,190	63,240	860,625	M	272,810
22	Q-1V-B	92	4,945	10,690	1,240	454,940	983,480	114,080	1,552,500	M	49,243
23	S-V-C	258	23,475	2,570	800	6,056,550	663,060	206,400	6,926,010	M	5,443,836
24	R-111-B	207	5,260	5,120	1,320	1,088,820	1,059,840	273,240	2,421,900	1B	
25	R-1V-B	896	7,255	5,465	930	6,500,480	4,896,640	833,280	12,230,400	M	5,210,150
25(a)	R-1V-C	230	12,295	7,120	490	2,827,850	1,637,600	112,700	4,578,150	M	2,298,256
26	S-111-B	110	6,435	715	925	707,850	78,650	101,750	888,250	1	
27	S-1V-B	114	10,385	2,335	910	1,183,890	266,190	103,740	1,553,820	MP	
28	R-V-B	506	11,240	4,270	1,895	5,687,440	2,160,620	958,870	8,806,930	M	6,076,761
29	R-1V-C	216	12,295	7,120	490	2,655,720	1,537,920	105,840	4,299,480	M	2,158,349
30	R-1V-B	311	7,255	5,465	930	2,256,305	1,699,615	289,230	4,245,150	M	1,808,455
31	Burn	363								B	
32	Q-1V-B	116	4,945	10,690	1,240	543,950	1,175,900	136,400	1,856,250	M	588,431
33	S-1V-B	790	10,385	2,335	910	8,204,150	1,844,650	718,900	10,767,700	M	6,342,175
34		172								BD	
35	S-V-B	1,103	14,280	660	220	15,750,840	727,980	242,660	16,721,480	M	13,427,365
36	S-111-B	393	6,435	715	925	2,528,955	280,995	363,525	3,173,475	1P	
37	ʬ ʬ	29								B	
TOTAL		14,084				79,878,695	44,671,420	7,254,515	131,704,630		61,811,019

Timber		9,905
Burn	3,713	
Barron	466	4,179
Total		14,084

COMPILATION SHEET

BLOCK NORTH RACEHORSE 9,519 ac.

			Per	Acre			Total	Stand			
Type No.	Type Symbol	Area	Spruce	Pine	Balsam	Spruce	Pine	Balsam	Total	Classification	Merchant
1	P-111-A	253	290	2,490	170	73,370	629,970	43,010	746,350	1	
2	P-111-A	96	290	2,490	170	27,840	239,040	16,320	283,200	1	
3	R-1V-B	154	7,255	5,465	930	1,117,270	841,610	143,220	2,102,100	M	895,495
4	P-111-A	94	290	2,490	170	27,260	234,060	15,980	277,300	1	
5	R-1V-B	381	7,255	5,465	930	2,764,155	2,082,165	354,330	5,200,650	M	2,215,498
6	S-1V-C	188	20,530	945	560	3,859,640	177,660	105,280	4,142,580	M	2,705,118
7	^ ^ ^	42								B	
8	Q-1V-B	495	4,945	10,690	1,240	2,447,775	5,291,550	613,800	8,353,125	M	2,647,942
9	R-1V-B	55	7,255	5,465	930	399,025	300,575	51,150	750,750	M	319,841
10	Q-111-B	394	2,290	10,090	1,450	902,260	3,975,460	571,300	5,449,020	1	
11	Q-1V-B	364	4,945	10,690	1,240	1,799,980	3,891,160	451,360	6,142,500	M	1,947,173
12	S-1V-B	119	10,385	2,335	910	1,235,815	277,865	108,290	1,621,970	M	955,358
13	S-1V-B	3,790	10,385	2,335	910	39,359,160	8,849,650	3,448,900	51,657,700	M	30,942,962
14	Q-1V-B	247	4,945	10,690	1,240	1,221,415	2,640,430	306,280	4,168,125	M	1,321,297
15	R-1V-B	121	7,255	5,465	930	877,855	661,265	112,530	1,651,650	M	703,624
16	S-1V-C	312	20,530	945	560	6,405,360	294,840	174,720	6,874,920	M	4,489,310
17	P-111-A	151	290	2,490	170	43,790	375,990	25,670	445,450	1	
18	S- V -C	402	23,475	2,570	800	9,436,950	1,033,140	321,600	10,791,690	M	8,482,276
19	R-1V-B	200	7,255	5,465	930	1,451,000	1,093,000	186,000	2,730,000	M	1,162,980
20	Q-1V-B	193	4,945	10,690	1,240	954,385	2,063,170	239,320	3,256,875	M	1,032,437
21	R-1V-B	124	7,255	5,465	930	899,620	677,660	115,320	1,692,600	M	721,048
22	Q-111-B	203	2,290	10,090	1,450	464,870	2,048,270	294,350	2,807,490	1P	
23	S-111-B	433	6,435	715	925	2,786,355	309,595	400,525	3,496,475	1P	
24	S-V-B	648	14,280	660	220	9,253,440	427,680	142,560	9,823,680	M	7,872,371
25	Q-1V-B	60	4,945	10,690	1,240	296,700	641,400	74,400	1,012,500	M	320,963
TOTAL		9,519				88,105,280	39,057,205	8,316,215	135,478,700		68,735,693

Timber	9,477
Burn	
Barron	42
TOTAL	9,519

BLOCK EAST DUTCH 14,205 acres.

COMPILATION SHEET

Type No.	Type Symbol	Area	Per Acre			Total Stand				Classification	Mercnantable
			Spruce	Pine	Balsam	Spruce	Pine	Balsam	Total		
1	Missing										
2	P-111-A	219	290	2,490	170	63,510	545,310	37,230	646,050	1	
3	S-1V-B	183	10,385	2,335	910	1,900,455	427,305	166,530	2,494,290	MP	
4	S-1V-C	2,394	20,530	945	560	49,148,820	2,262,330	1,340,640	52,751,790	M	34,446,925
5	Q-1V-C	117	9,610	13,650	1,390	1,124,370	1,597,050	162,630	2,884,050	M	1,116,147
6	Q-1V-C	105	9,610	13,650	1,390	1,009,050	1,433,250	145,950	2,588,250	M	1,001,672
7	P-111-A	141	290	2,490	170	40,890	351,090	23,970	415,950	1	
8	^ ^ ^	72								B	
9	R-1V-B	330	7,255	5,465	930	2,394,150	1,803,450	306,900	4,504,500	MP	
10	S-1V-B	280	10,385	2,335	910	2,907,800	653,800	254,800	3,816,400	M	2,247,860
11	^ ^ ^	29								B	
12	R-1V-B	301	7,255	5,465	930	2,183,755	1,644,965	279,930	4,108,650	M	1,750,306
13	S-V-C	1,131	23,475	2,570	800	26,550,225	2,906,670	904,800	30,361,695	M	23,864,296
14	S-111-B	922	6,435	715	925	5,933,070	659,230	852,850	7,445,150	1	
15	P-1V-B	260	1,520	15,340	1,120	395,200	3,988,400	291,200	4,674,800	MP	
16	S-V-C	551	23,475	2,570	800	12,934,725	1,416,070	440,800	14,791,595	M	11,626,198
17	R-1V-C	349	12,295	7,120	490	4,290,955	2,484,880	171,010	6,946,845	M	3,487,319
18	S-111-B	214	6,435	715	925	1,377,090	153,010	197,950	1,728,050	1	
19	S-111-B	235	6,435	715	925	1,512,225	168,025	217,375	1,897,625	1	
20	^ ^ ^	26								B	
21	S-1V-B	82	10,385	2,335	910	851,570	191,470	74,620	1,117,660	M	693,253
22	^ ^ ^	29								B	
23	S-1V-B	126	10,385	2,335	910	1,308,510	294,210	114,660	1,717,380	M	1,011,549
24	Q-111-B	187	2,290	10,089	1,450	428,230	1,886,643	271,150	2,586,023	1	
25	R-111-B	80	5,260	5,120	1,320	420,800	409,600	105,600	936,000	1	
26	R-1V-C	252	12,295	7,120	490	3,098,340	1,794,240	123,480	5,016,060	M	2,518,082
27	P-111-A	72	290	2,490	170	20,880	179,280	12,240	212,400	1	
28	R-1V-B	77	7,255	5,465	930	558,635	420,805	71,610	1,051,050	M	447,769
29	P-111-A	77	290	2,490	170	22,330	191,730	13,090	227,150	1	
30	S-V-B	726	14,280	660	220	10,367,280	479,160	159,720	11,006,160	M	8,837,979
31	Q-1V-B	759	4,945	10,690	1,240	3,753,255	8,113,710	941,160	12,808,125	M	4,060,188
32	S-1V-B	284	10,385	2,335	910	2,949,340	663,140	258,440	3,870,920	M	2,279,960
33	^ ^ ^	36								B	
34	R-1V-B	714	7,255	5,465	930	5,180,070	3,902,010	664,020	9,746,100	M	4,151,839
35	P-111-A	189	290	2,490	170	54,810	470,610	32,130	557,550	1P	
36	R-111-B	227	5,260	5,120	1,320	1,194,020	1,162,240	299,640	2,655,900	1P	
37	Q-111-B	143	2,290	10,089	1,450	327,460	1,442,727	207,350	1,977,537	1	
38	S-111-B	264	6,435	715	925	1,698,840	188,760	244,200	2,131,800	1P	
39	^ ^ ^	141								BP	
TOTAL											

Timber	13,872
Burn	------
Barren	333
Total	14,205

FORWARD

COMPILATION SHEET

BLOCK EAST DUTCH

Type No.	Type Symbol	Area	Per Acre Spruce	Per Acre Pine	Per Acre Balsam	Total Stand Spruce	Total Stand Pine	Total Stand Balsam	Total Stand Total	Classification	Merchantable
Brought Forward:		12,324									
40	P-111-A	148	290	2,490	170	42,920	368,520	25,160	436,600	1P	
41	^ ^ ^	105								BP	
42	S-111-B	474	6,425	715	925	3,050,190	338,910	438,450	3,827,550	1	
43	S-1V-B	467	10,385	2,335	910	4,849,795	1,090,445	424,970	6,365,210	M	3,749,103
44	R-1V-B	687	7,255	5,465	930	4,984,185	3,754,455	638,910	9,377,550	M	3,994,858
TOTAL		14,205				158,927,760	49,837,500	10,915,165	219,680,425		111,285,283

COMPILATION SHEET

BLOCK WEST DUTCH 11,745 ac.

			Per	Acre			Total	Stand			
Type No.	Type Symbol	Area	Spruce	Pine	Balsam	Spruce	Pine	Balsam	Total	Classification	Merchantable.
1	S-111-B	644	6,43 5	715	925	4,144,140	460, 460	595,700	5,200,300	1	
2	P-1V-B	56	1,520	15,340	1,120	85,120	859,040	62,720	1,006,880	MP	
3	P-111-A	63	290	2,490	170	18,270	156,870	10,710	185,850	1	
4	S-V-C	532	23,475	2,570	800	12,488,700	1,367,240	425,600	14,281,540	M	11,225,259
5	S-V-D	594	34,600	490	320	20,552,400	291,060	190,080	21,033,540	M	15,543,757
6	Q-1V-B	122	4,945	10,690	1,240	603,290	1,304,180	151,280	2,058,750	M	652,640
7	S-1V-B	300	10,385	2,335	910	3,115,500	700,500	273,000	4,089,000	MP	
8	S-V-C	563	23,475	2,570	800	13,216,425	1,446,910	450,400	15,113,735	M	11,679,368
9	S-V-B	579	14,280	660	220	8,268,120	382,140	127,380	8,777,640	MP	
10	Q-111-B	260	2,290	10,090	1,450	595,400	2,623,400	377,000	3,595,800	1P	
11	S-1V-B	4,878	10,385	2,335	910	50,658,030	11,390,130	4,438,980	66,487,140	M	39,160,902
12	P-1V-B	187	1,520	15,340	1,120	284,240	2,868,580	209,440	3,362,260	MP	
13	R-1V/B	64	7,255	5,465	930	464,320	349,760	59,520	873,600	M	3,721,536
14	R-111-B	301	5,260	5,120	1,320	1,583,260	1.541,120	397,320	3,521,700	1P	
15	S-V-C	775	23,475	2,570	800	18,193,125	1,991,750	620,000	20,804,875	MP	
16	Q-1V-B	498	4,945	10,690	1,240	2,462,610	5,323,620	617,520	8,403,750	MP	
17	^ ⸙ ^	112								PB	
18	R-1V-B	502	7,255	5,465	930	3,642,010	2,743,430	466,860	6,852,300	MP	
19	S-111-B	67	6,435	715	925	431,145	47,905	61,975	541,025	1P	
20	^ ^ ^	39								BP	
21	S-1V-B	224	10,385	2,335	910	2,326,240	523,040	203,840	3,053,120	MP	
22	S-111-B	107	6,435	715	925	688,545	76,505	98,975	864,025	1P	
23	^ ⸙ ^	112								BP	
24	S-111-B	166	6,435	715	925	1,068,210	118,690	153,550	1,340,450	1P	
Total		11,745				144,88 9,100	36,566,330	9,991,850	191,447,280		82,183,462

Timber	11,482
Burn	---
Barren	263
Total	11,745

APPENDIX X

Standard Deviation

By type

Based on formula $\Sigma = \sqrt{\frac{(M-m)^2}{M(n-1)} \quad \underline{100}}$

S-V-C

S-No	M	m	M-m	$(M-m)^2$
32	26.5	26.4	0.1	0.01
33A	26.5	31.8	5.3	28.09
15	26.5	28.1	1.6	2.56
13	26.5	39.8	13.3	176.90
19	26.5	26.5	0.0	0.00
26	26.5	25.6	1.0	1.00

$$\frac{208.56}{5}$$

$$\sqrt{41.71}$$

6.46

$$\frac{6.46 \times 100}{26.5}$$

$\Sigma = 24\%$

S-IV-C

S-No	M	m	M-m	$(M-m)^2$
	23.4	23.1	0.3	.09
8		28.6	5.2	27.04
16		27.7	4.3	18.49
17		24.4	1.0	1.00
20		19.8	3.6	12.96
24		17.8	5.6	31.36

1404

$$\frac{90.94}{5} = \sqrt{18.18}$$

$$\frac{4.27 \times 100}{23.4}$$

$\Sigma = 18\%$

S - IV - B

S-No	M	m	M-m	$(M-m)^2$
9	14.7	14.2	0.5	.25
11		15.2	0.5	.25
11		15.9	1.2	1.44
12		13.1	1.6	2.56
22		19.9	5.2	27.04
23		12.0	2.7	7.29
29		12.3	2.4	5.76
		102.6		

$$\frac{44.59}{6} = 7.432$$

$$\frac{2.7}{14.7} \times 100$$

$$\Sigma = 18\%$$

R-IV-B

S-No	M	m	M-m	$(M-m)^2$
36	14.5	9.6	4.9	24.01
30		15.1	0.6	0.36
26		15.2	0.7	0.49
20		18.2	3.7	13.69
		5.81		

$$\frac{38.55}{3} = 12.85$$

$$\frac{3.6}{14.5} \times 100$$

$$\Sigma = 24.8\%$$

Average Error 21%

STANDARD

DEVIATION

By Tally

S-V-C

S-No.	A	B	C	D Mean		% Deviation
32	25.5	27.4		26.4		3.6
15	29.0	27.3		28.1		2.9
19	20.2	32.8		26.5		27.8
26 m	18.8	28.2	27.7	27.0	25.5	
M-m	6.7	2.7	2.2	15.8		
$(M-m)^2$	44.9	7.29	4.84	2.25	34.8	

$\frac{59.28}{3} = \sqrt{19.76} = 4.44$ 17.4

Average Error 11.9%

S-IV-C

S-No.	A	B	C	D Mean		% Deviation
8	25.8	31.4		28.6		10.0
16	32.3	23.0		27.7		16.4
17	19.0	31.7	22.6	24.4		24.2
24	18.6	17.0		17.8		4.5
20 m	11.9	11.8	21.1	27.4	19.8	
M-m	7.9	8.0	1.3	7.1		
$(M-m)^2$	62.51	64.00	16.9	57.86		37.9

$\frac{186.06}{3} = \sqrt{62.02} = 7.8$

Average Error 18.6

S-IV-B

S-No.	A	B	C	D	Mean	% Deviation
9	13.8	14.6			14.2	2.7
12	12.6	13.7			13.1	4.6
22	20.6	18.2			19.9	8.6
23	13.1	11.0			12.0	8.3
29	15.1	9.5			12.3	22.8
10	17.7	17.2			17.5	1.7
10	16.4	15.3			15.8	3.1

Average Error 7.4% $\frac{51.8}{7}$

11.9
18.6
7.4
37.9
12.6

Error 12.6%

APPENDIX X.I

FIELD CHECK SHEET

STRIP
NO.......
PLOT

PERCENT COMPOSITION					
SPECIES					
%					

AVERAGE HT:	
HEIGHT CLASS.	

DENSITY CLASS.

AGE CLASS.

TYPE SYMBOL.

S I T E

REGENERATION			
SPECIES	No. PER AC.	STOCKING	VIGOR

S O I L

MAIN STAND			
VIGOR		WIND FALL	
DISEASE		BRUSH	
INSECTS		CULL FACTOR	
GROUND COVER		LOGGING CHANCE	

TALLY SHEET

Strip/Plot No.............

Cruised by:

Area of Strip/Plot

SPECIES	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		TOTAL.
SPA																													
VPA																													
SPA																													
VPA																													
SPA																													
VPA																													
SPA																													
VPA																													

HEIGHT MEASUREMENT.

Species																				
DBH																				
Reading																				
Distance																				
Base																				
Height																				
Age																				

FORM FACTOR

Species					
DBH					
Total length					
DMH					
Form Factor					

DUTCH CREEK TIMBER

AREA OUTLINED~69.05 SQ. MI.

DUTCH CREEK AREA

STAND MAP

SCALE: 2 inches equals 1 mile.